Claims

Amendment to the Claims

This listing of Claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims

1. (Currently amended) An electrical current generation system comprising:

a high temperature fuel cell having an anode inlet and an anode exhaust outlet; ~~and~~ a rotary adsorption module fluidly connected to the anode exhaust outlet and the anode inlet, and operable to receive exhaust gas from the anode exhaust outlet, to separate and enrich usable fuel gas from the exhaust gas by displacement purge adsorptive means, ~~and to deliver~~ wherein the rotary adsorption module comprises:

a rotor and a stator mutually defining a rotary distributor valve, wherein the rotor comprises:

plural adsorbers having first and second ends, each adsorber comprising an adsorbent material and defining a flow path in contact with the adsorbent material between the first and second ends;

a first rotor valve surface fluidly coupled to the first ends of the adsorbers; and

a second rotor valve surface fluidly coupled to the second ends of the adsorbers;

and wherein the stator comprises:

a first stator valve surface in relatively rotatable communication with the first rotor valve surface;

a second stator valve surface in relatively rotatable communication with the second rotor valve surface;

a feed gas function compartment opening into at least one of the first stator valve surface or the second stator valve surface and configured to provide the exhaust gas from the anode exhaust outlet to adsorbers through the first stator valve surface or the second stator valve surface and the first rotor valve surface or the second rotor valve surface;

a displacement purge gas function compartment opening into at least one of the first stator valve surface or the second stator valve surface and configured to provide a displacement

purge gas to the adsorbers through the first stator valve surface or the second stator valve surface and the first rotor valve surface or the second rotor valve surface; and

a buffer gas function compartment configured to provide a buffer gas to the adsorbers through the first stator valve surface or the second stator valve surface and the first rotor valve surface or the second rotor valve surface,

wherein at least a portion of such enriched usable fuel gas ~~for export~~ is exported from the generation system as fuel for external use in a downstream system.

2. (Currently amended) The electrical current generation system according to claim 1, additionally comprising:

a second gas separation system fluidly connected to the rotary adsorption module ~~operable~~ and configured to further purify the usable fuel gas component in the exported portion of the enriched fuel gas, for external use in a downstream system.

3. (Original) The electrical current generation system according to claim 1 wherein the high temperature fuel cell is a solid oxide fuel cell.

4. (Original) The electrical current generation system according to claim 1 wherein the high temperature fuel cell is a molten carbonate fuel cell.

5. (Currently amended) The electrical current generation system according to claim 1 wherein the rotary adsorption module is ~~additionally operable to~~ fluidly coupled to the anode inlet to deliver at least a portion of the enriched usable fuel gas to the anode inlet.

6. (Original) The electrical current generation system according to claim 2 wherein the second gas separation system is a pressure swing adsorption system.

7. (Currently amended) The electrical current generation system according to claim 6 wherein the downstream system comprises a high pressure hydrogen storage system ~~operable~~ configured to store purified hydrogen fuel for dispensing to hydrogen vehicles.

8. (Currently amended) An electrical current generation system comprising:

a molten carbonate fuel cell comprising an anode inlet and an anode exhaust outlet;

a rotary adsorption module, containing adsorbent material, fluidly connected to the anode exhaust outlet and the anode inlet, and operable to receive exhaust gas from anode exhaust outlet, to separate and enrich usable fuel gas from the exhaust gas by displacement purge adsorptive means to leave a fuel depleted waste gas stream, and to deliver at least a portion of such enriched usable fuel gas to the anode inlet; ~~and~~

wherein the rotary adsorption module comprises:

a rotor and a stator mutually defining a rotary distributor valve, wherein the rotor comprises:

plural adsorbers having first and second ends, each adsorber comprising an adsorbent material and defining a flow path in contact with the adsorbent material between the first and second ends;

a first rotor valve surface fluidly coupled to the first ends of the adsorbers; and

a second rotor valve surface fluidly coupled to the second ends of the adsorbers;

and wherein the stator comprises:

a first stator valve surface in relatively rotatable communication with the first rotor valve surface;

a second stator valve surface in relatively rotatable communication with the second rotor valve surface;

a feed gas function compartment opening into at least one of the first stator valve surface or the second stator valve surface and configured to provide the exhaust gas from the anode exhaust outlet to adsorbers through the first stator valve surface or the second stator valve surface and the first rotor valve surface or the second rotor valve surface;

a displacement purge gas function compartment opening into at least one of the first stator valve surface or the second stator valve surface and configured to provide a displacement purge gas to the adsorbers through the first stator valve surface or the second stator valve surface and the first rotor valve surface or the second rotor valve surface;

a buffer gas function compartment configured to provide a buffer gas to the adsorbers through the first stator valve surface or the second stator valve surface and the first rotor valve surface or the second rotor valve surface; and

a heat exchange means ~~operable~~ configured to increase the temperature of ~~a~~ the displacement purge gas, and to deliver such heated displacement purge gas to the displacement purge rotary adsorption module to assist desorption of the fuel depleted waste gas stream from the adsorbent material.

9. (Currently amended) The electrical current generation system according to claim 8, wherein the molten carbonate fuel cell further comprises a cathode inlet, and the rotary adsorption module is further ~~operable~~ configured to deliver at least a portion of the fuel depleted waste gas to the cathode inlet.

10. (Currently amended) The electrical current generation system according to claim 8 wherein the rotary adsorption module is further ~~operable~~ configured to deliver at least a portion of the enriched usable fuel gas for export from the generation system as fuel for external use in a downstream system.

11. (Currently amended) The electrical current generation system according to claim 8 additionally comprising a second heat exchange means ~~operable~~ configured to receive anode exhaust gas from the anode exhaust gas outlet, to reduce the temperature of the anode exhaust gas and to provide the cooled anode exhaust gas to the rotary adsorption module to enhance the adsorption of the fuel depleted waste gas from the anode exhaust gas.

12. (Currently amended) A process for generating electrical current from a high temperature fuel cell having an anode inlet and an anode exhaust outlet comprising:

~~providing a high temperature fuel cell having an anode inlet and an anode exhaust outlet, and a rotary adsorption module;~~

~~providing~~ introducing anode exhaust gas from the anode exhaust outlet as a feed gas mixture ~~to the~~ into a rotary adsorption module, wherein the rotary adsorption module includes at least a first adsorber and a second adsorber, each adsorber having a flow path in contact with an adsorbent material between a first and a second end and the anode exhaust gas includes a fuel gas component and a second gas component;

~~separating and enriching usable fuel gas from the anode exhaust gas by adsorptive means in the rotary adsorption module;~~

withdrawing a product gas enriched in the fuel gas component from the first adsorber;

supplying a first buffer gas substantially free of the fuel gas component to the first adsorber to substantially displace any remaining fuel gas component from the first adsorber;

supplying a less-readily adsorbed purge gas to the first adsorber to substantially desorb adsorbed second component from the adsorbent material; and

providing at least a portion of such enriched usable fuel gas for export from the generation system for use as fuel for external use in a downstream system.

13. (Original) The process according to claim 12 additionally comprising providing at least a portion of the enriched usable fuel gas for recycle to the anode inlet.

14. (Original) The process according to claim 12 wherein the high temperature fuel cell is a solid oxide fuel cell.

15. (Original) The process according to claim 12 wherein the high temperature fuel cell is a molten carbonate fuel cell.

16. (New) The system of claim 1, wherein the ~~solid oxide~~ fuel cell comprises a cathode inlet and a cathode exhaust gas outlet, and the displacement purge gas function compartment is fluidly coupled to the cathode exhaust gas outlet to provide cathode exhaust gas as the displacement purge gas.

17. (New) The system of claim 1, wherein the adsorbent material comprises an adsorbent laminate structure having a void fraction of about 10% to 50% of the laminate structure volume.

18. (New) The system of claim 1, wherein the adsorbent material comprises an adsorbent laminate structure having a void fraction of about 20% to 30% of the laminate structure volume.

19. (New) The process according to claim 14 the fuel gas component is hydrogen, the second component is carbon dioxide, and the purge gas is air or nitrogen-enriched air.